



Plate Tectonics

Early History

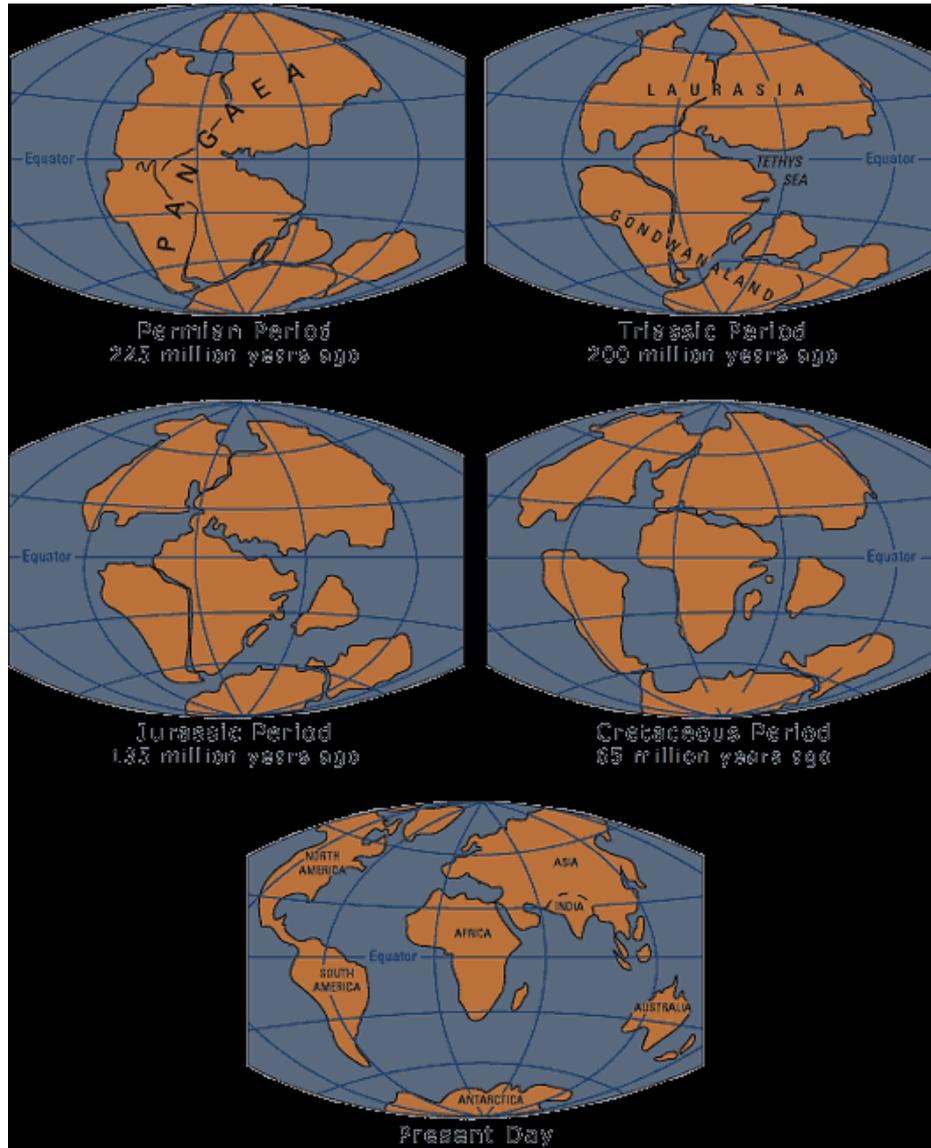
- In 1912, German meteorologist, Alfred Wegener hypothesized that the Earth had once been a single huge supercontinent
- He called it Pangaea, a Greek word meaning “all-land”



Alfred Wegener

- **Wegener believed this supercontinent fragmented into separate pieces and drifted apart**
- **He called this process Continental Drift**
- **Nobody believed his theory!**
- **Why? Because he couldn't explain what force could move the mass of a continent**

Pangaea

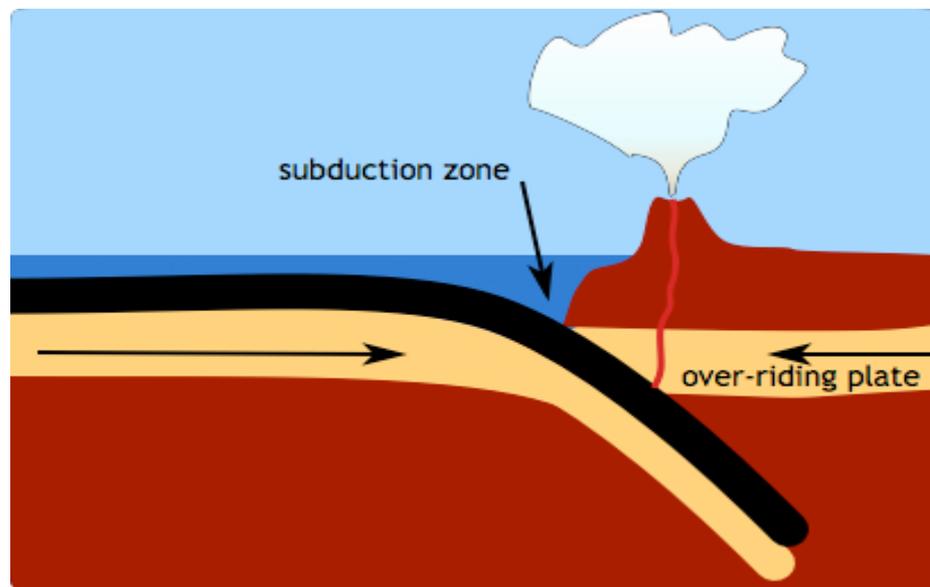
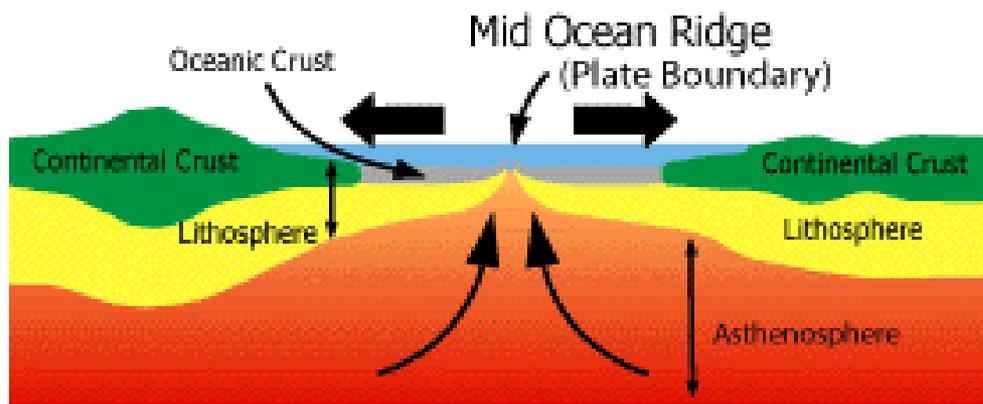


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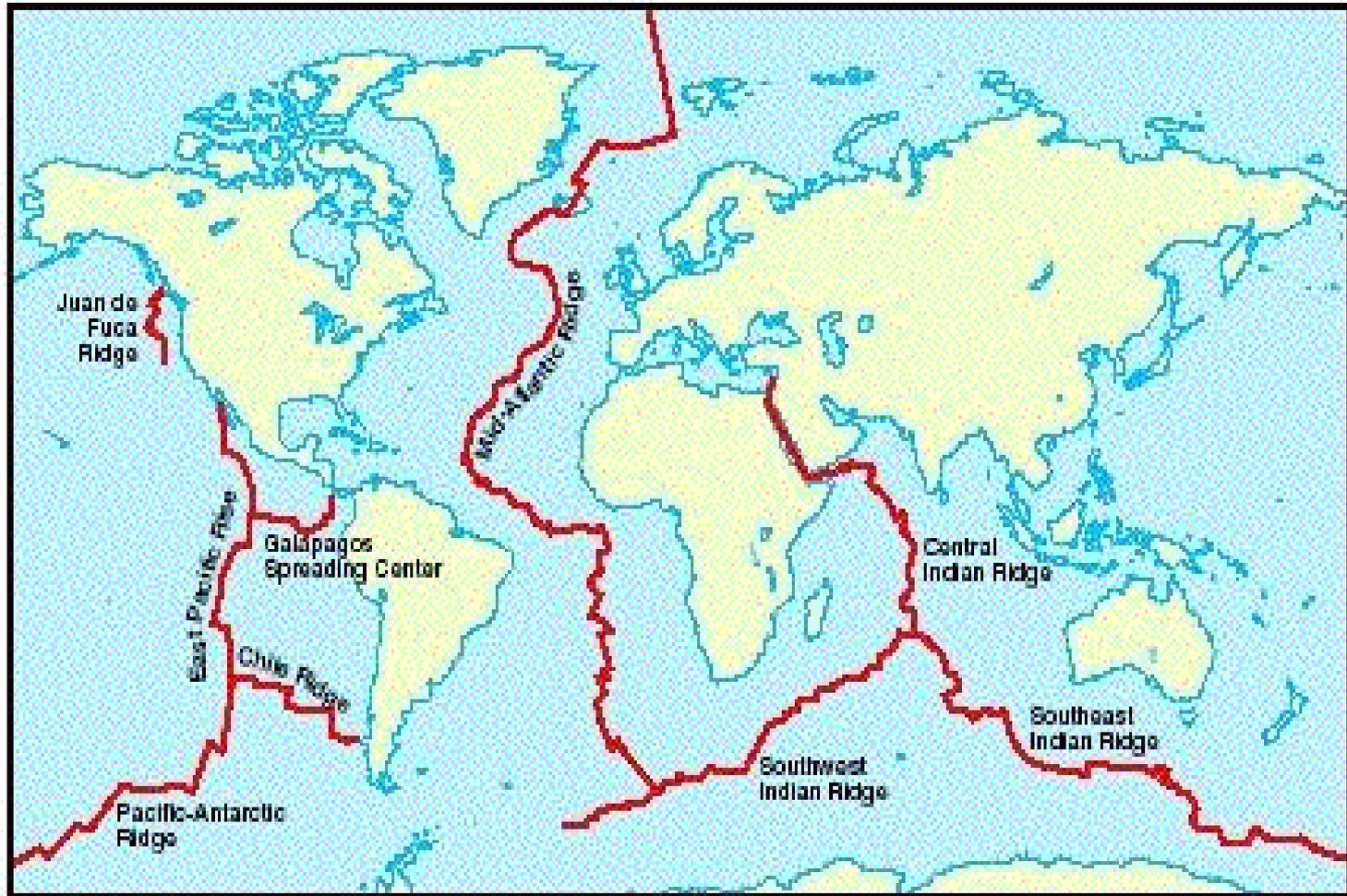
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- 50 Years after Wegener's Drift Theory, American geologist Harry Hess proposed The concept of sea floor spreading
- This is the idea that as the continents drift apart, new ocean floor forms between them
- Hess also suggested that as continents move toward each other, the old ocean floor between them sinks back down into the Earth's interior, this he called Subduction

Sea Floor Spreading

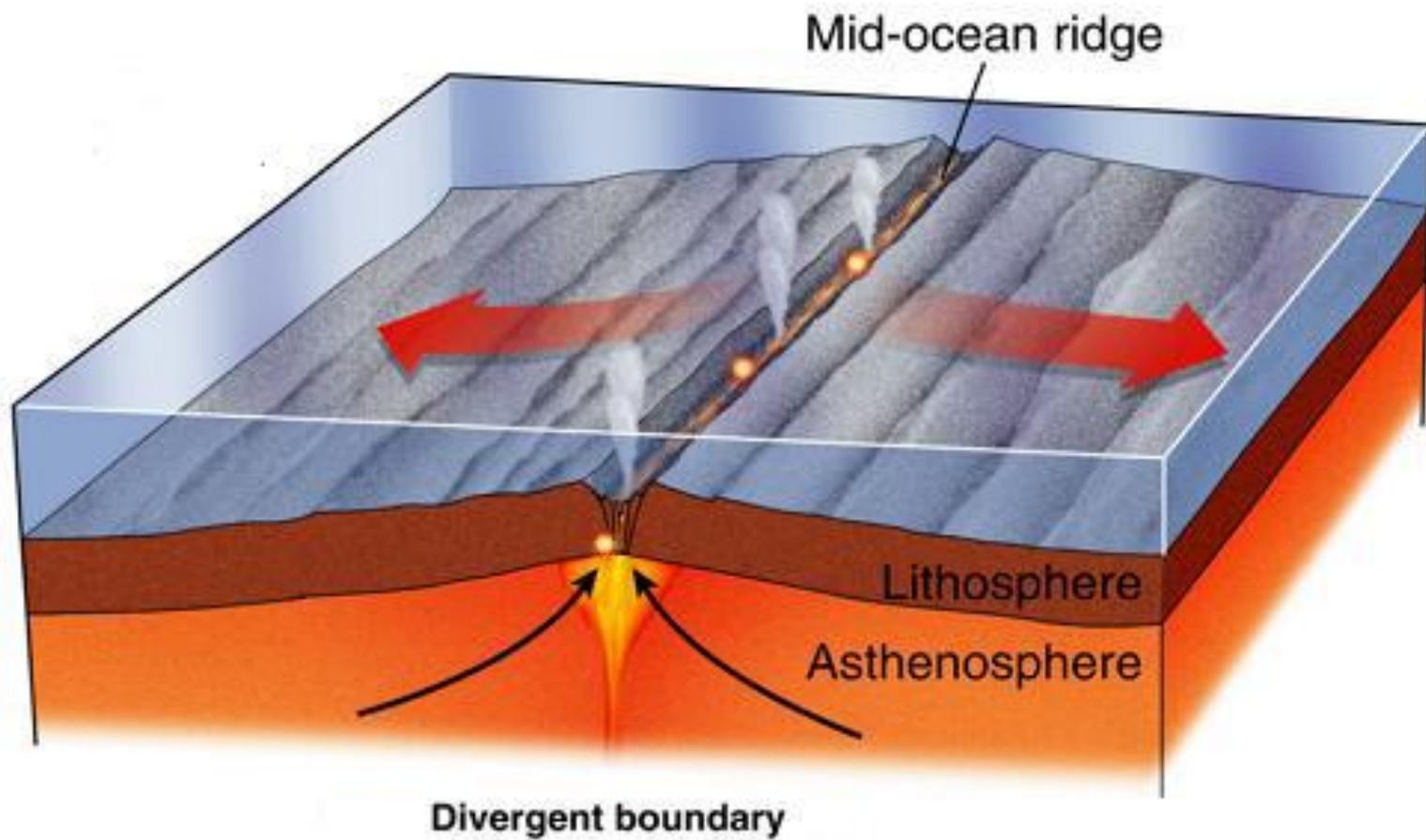


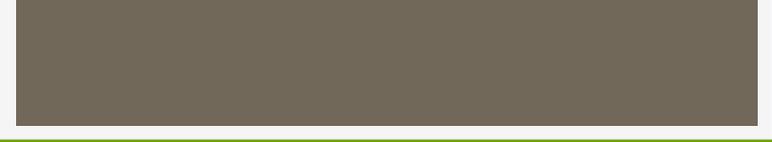
- ❖ Hess based his theory on the discovery of the Mid - Ocean Ridge
- ❖ It is a chain of underwater mountains that runs down the middle of all the Earth's oceans like a giant zipper
- ❖ It is the world's longest mountain chain
- ❖ The rocks on this chain turn out to be the youngest on the surface of the planet!









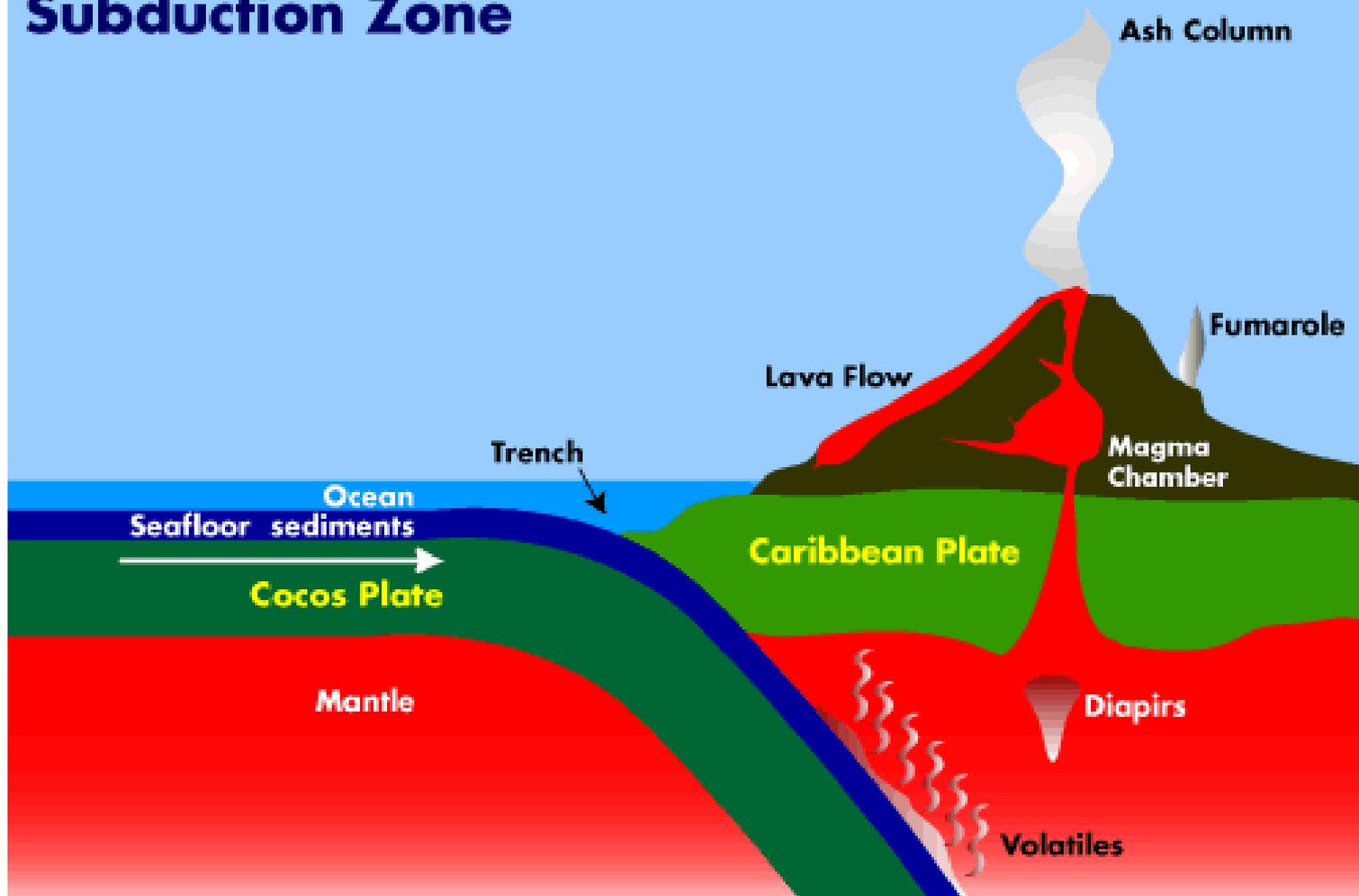


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<http://www.youtube.com/watch?v=GyMLLxbfa4>

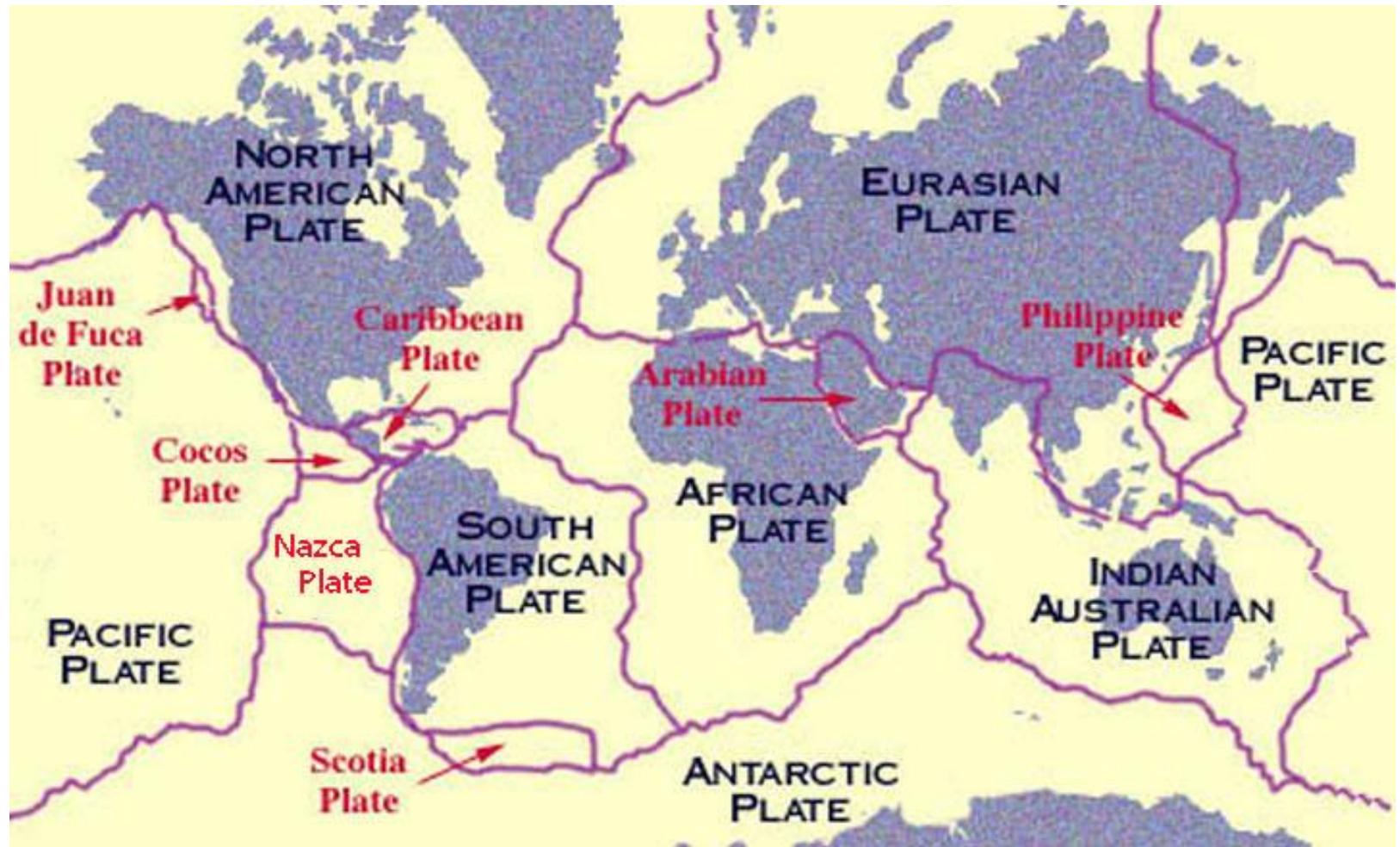
http://earthguide.ucsd.edu/eoc/teachers/t_tectonics/p_seafloorspreading.html

Anatomy of a Subduction Zone



Theory Of Plate Tectonics

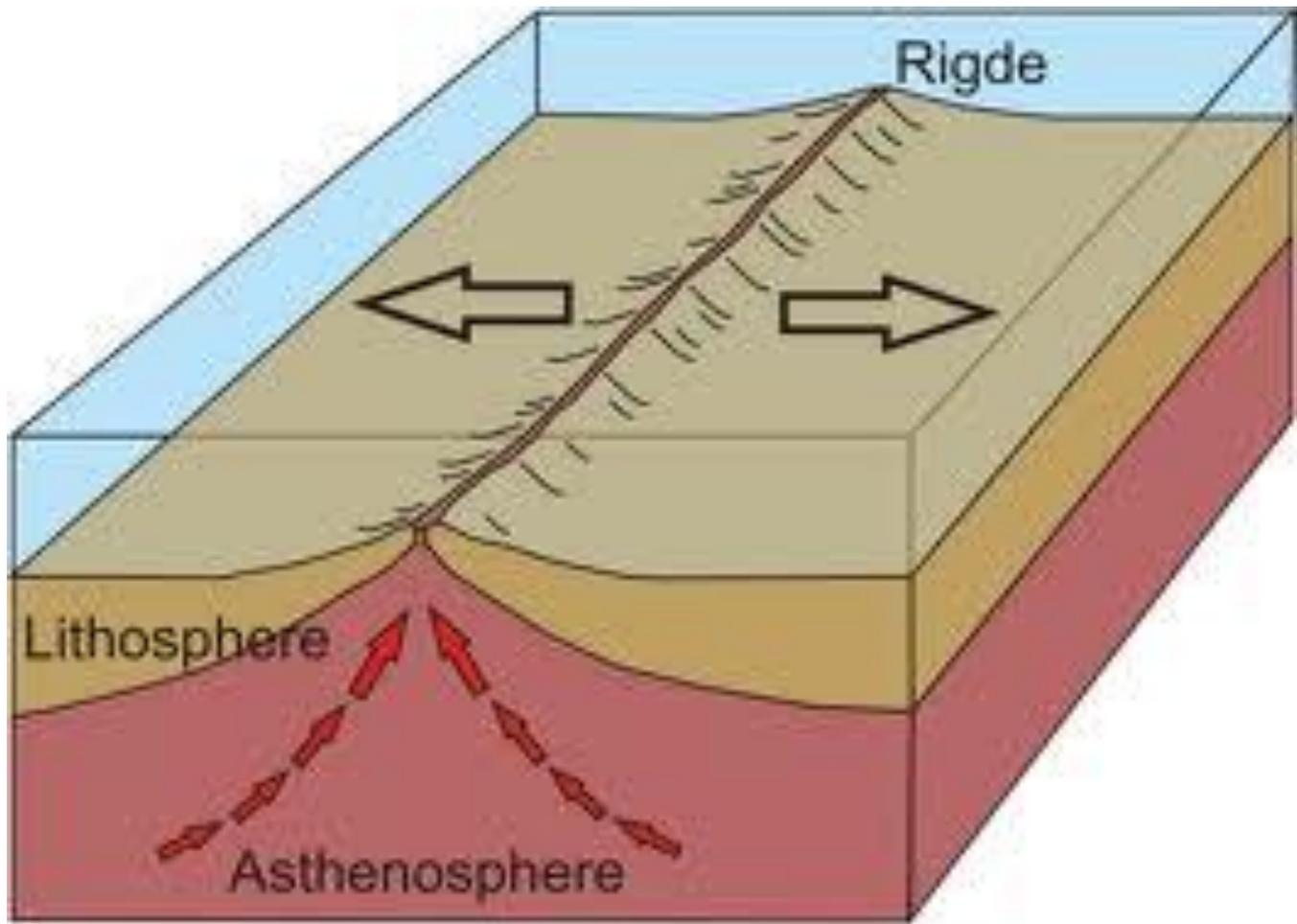
- Earth is made of 12 Large Plates and several smaller ones
- Plates are made of Lithosphere and move slowly around on the Asthenosphere
- Plates move from 1cm to 15 cm per year
- These plate movements “build” geologic features such as mountains, volcanoes, trenches, faults, and ridges
- The edges where two plates meet are called Plate boundaries



3 Types of Plate Boundaries

1. Divergent

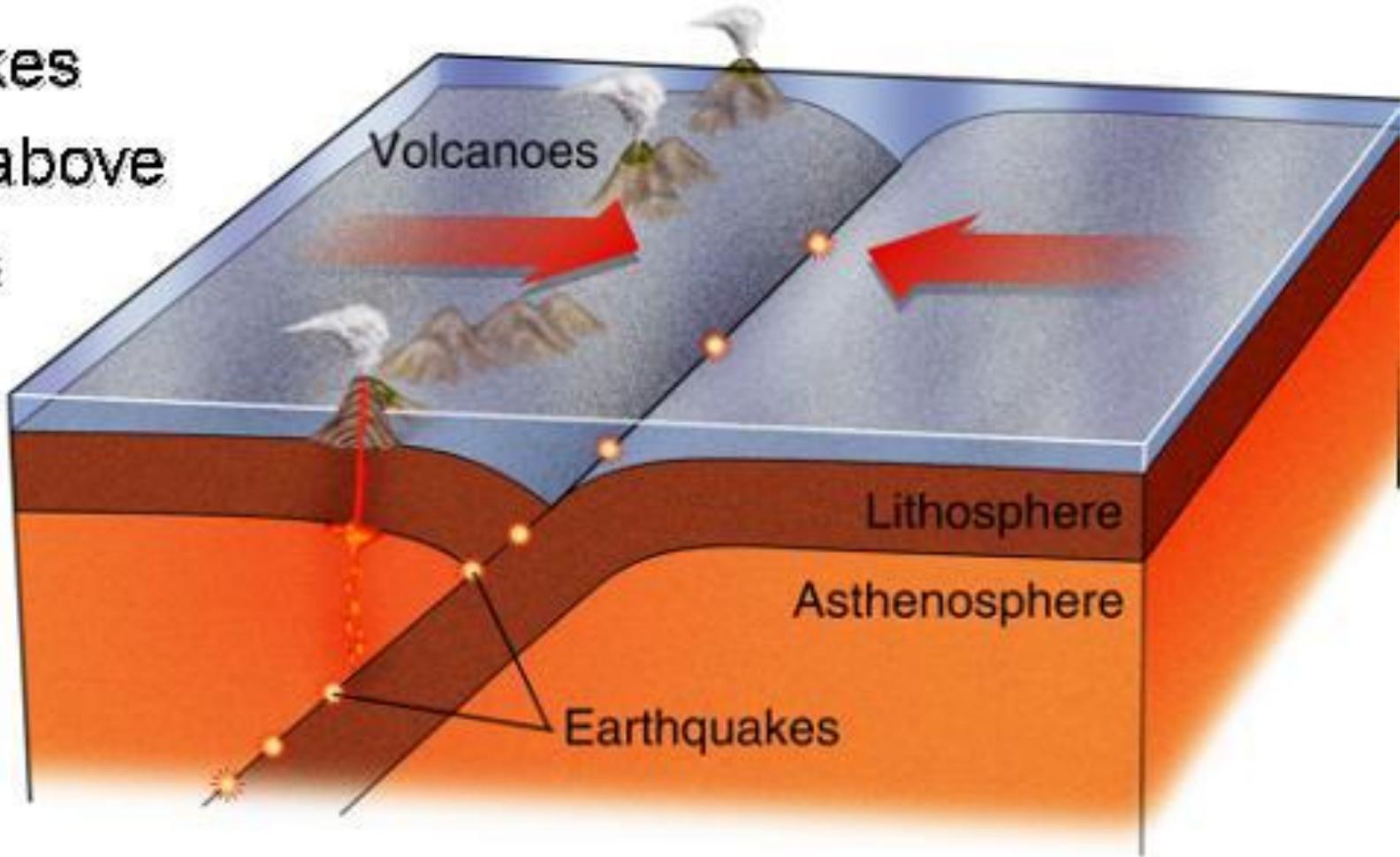
- Where two plates move apart from each other
- Open space does not develop, but instead new lithosphere forms at a mid ocean ridge
- As plates move apart, magma rises from the asthenosphere to fill the gap, the magma cools and forms basalt which becomes new sea floor



2. Convergent

- **Where two plates, at least one of which is oceanic, move toward each other**
- **As they collide, the oceanic plate bends and sinks beneath the continental plate into the asthenosphere...this is called subduction**
- **Why does the oceanic plate sink? Because it is denser**
- **We say that the oceanic plate is “consumed”**

kes
above

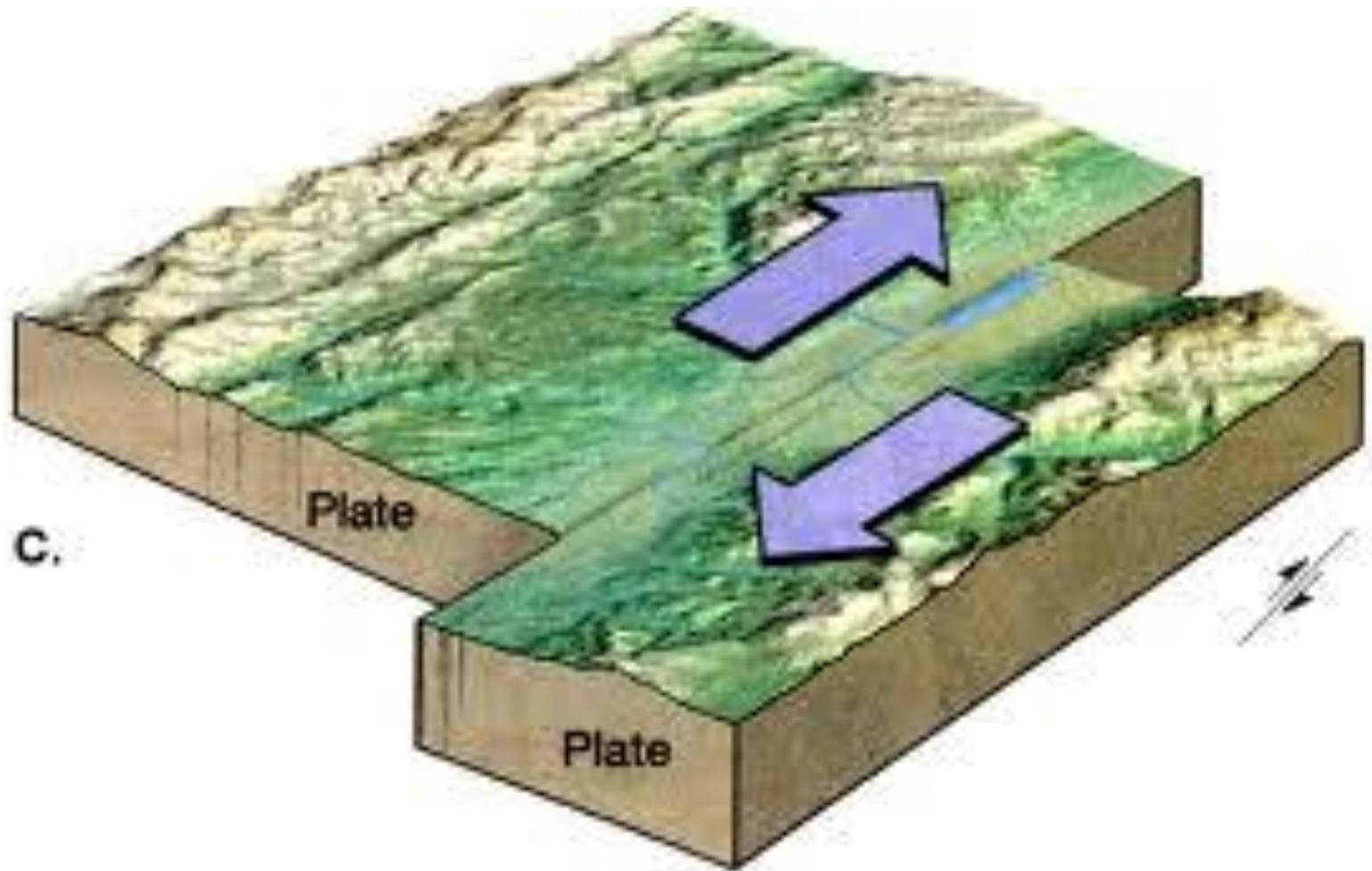


(b) Convergent boundary

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3. Transform

- **Where two plates slide sideways past each other**
- **No new plate forms**
- **No old plate is consumed**
- **Example: San Andreas Fault – transform boundary between North American Plate and Pacific Plate; cuts across California**





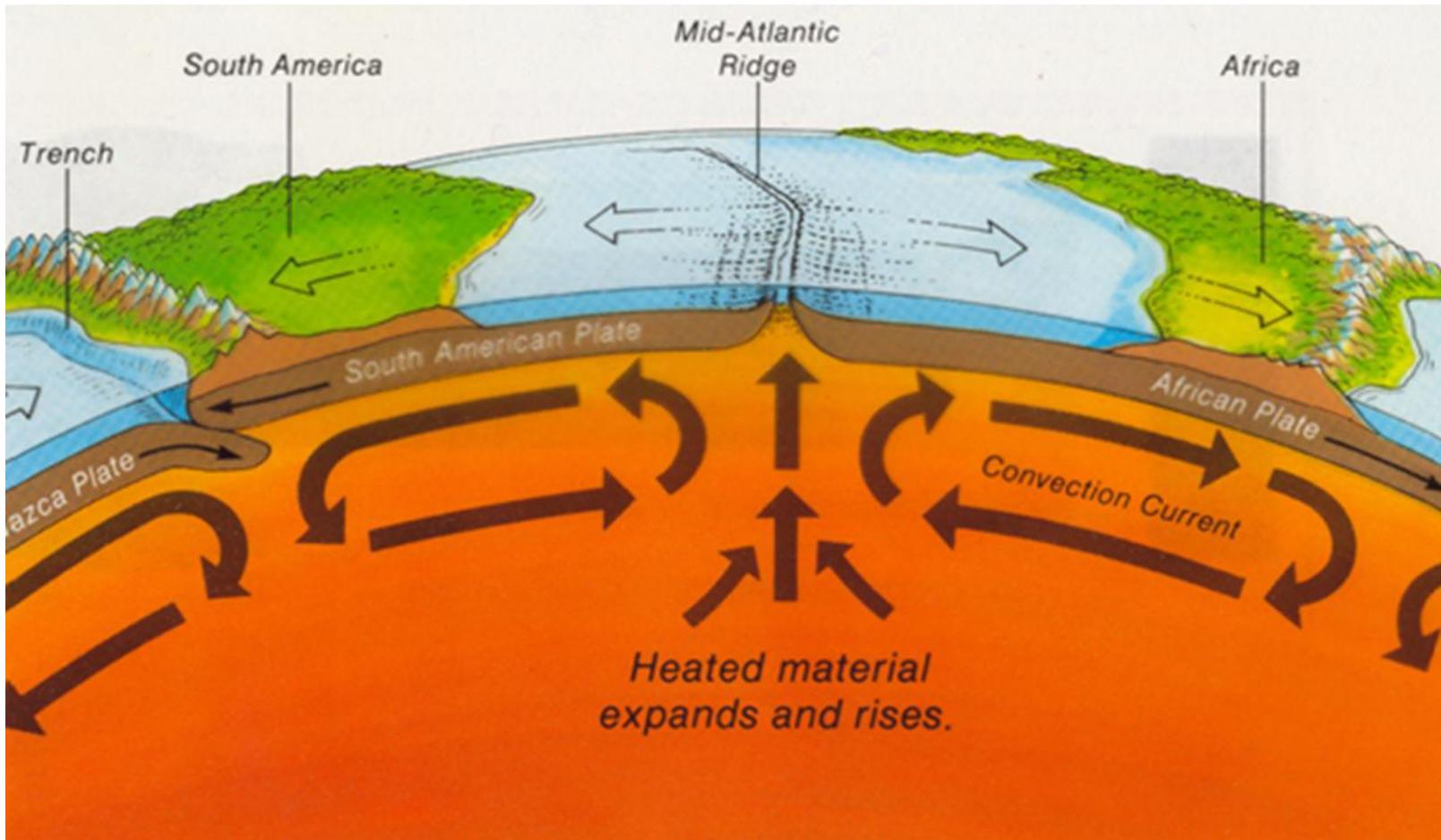
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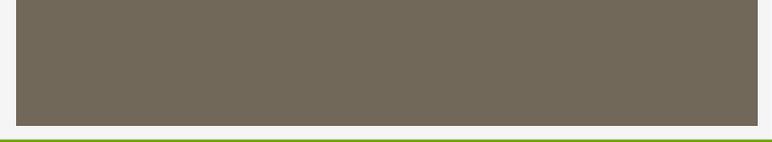
What Drives Plate Motion?

1. Convection in the mantle

- **Heat transfer that occurs when particles in a fluid (liquid or gas) move from one place to another due to differences in density**

- **Very hot materials at the deepest part of the mantle expand as they are heated, become less dense and rise toward the surface where they cool, contract, become more dense and sink**
- **Cycle repeats continuously creating a current that acts as a conveyer belt to move plates**





http://www.youtube.com/watch?v=Kpoko_I34ZE

Plate Motion is Also caused by:

2. Forces in the Lithosphere

- **Ridge Push : Lithosphere is elevated at divergent boundaries as magma pushes upward from the interior and gravity pushes downward on the lower lithosphere forcing plates apart**
- **Slab Pull: When the denser plate sinks and is subducted at convergent boundaries and gravity pulls the rest of the plate down behind it**

Wegener's Evidence

- 1. Fit of the Continents : “too good to be a coincidence”**
- 2. Past Glacier Records : As sheets of ice flowed across the land surface, they carried sediment and carved scratches into the land. These patterns can be studied and mapped**

3. Distribution of Climate Belts:
Compare the locations of coal, sand dunes, and salt deposits and align bands of rocks and resources that occupy appropriate latitudes

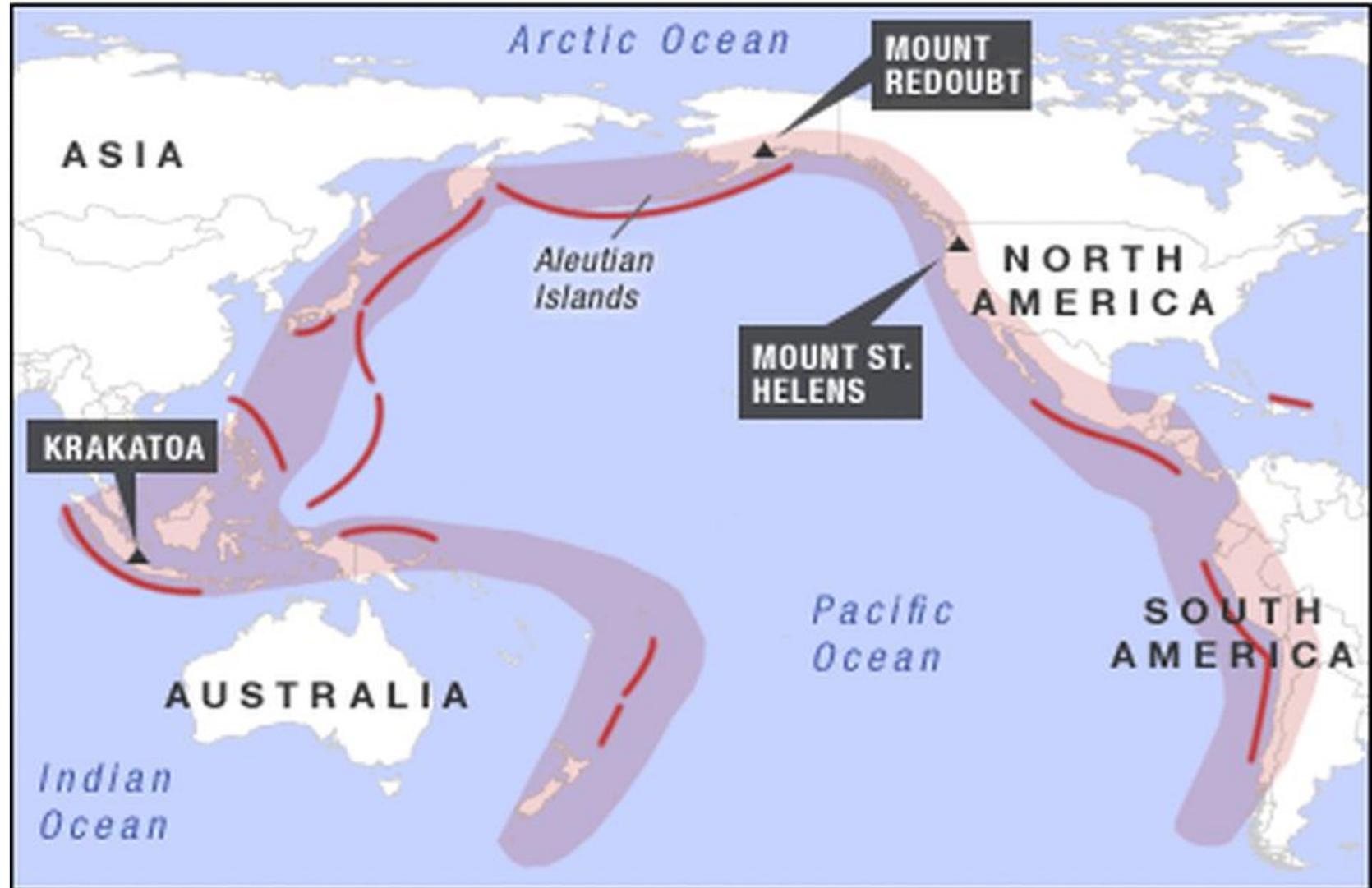
4. Distribution of Fossils: **Found certain species on several continents suggesting that they must have been adjacent to one another**

**5. Matching Rock Assemblages:
similar sedimentary rocks and
formations on continents now
separated by ocean. If continents
were joined, these formations
would form continuous belts of
rocks**

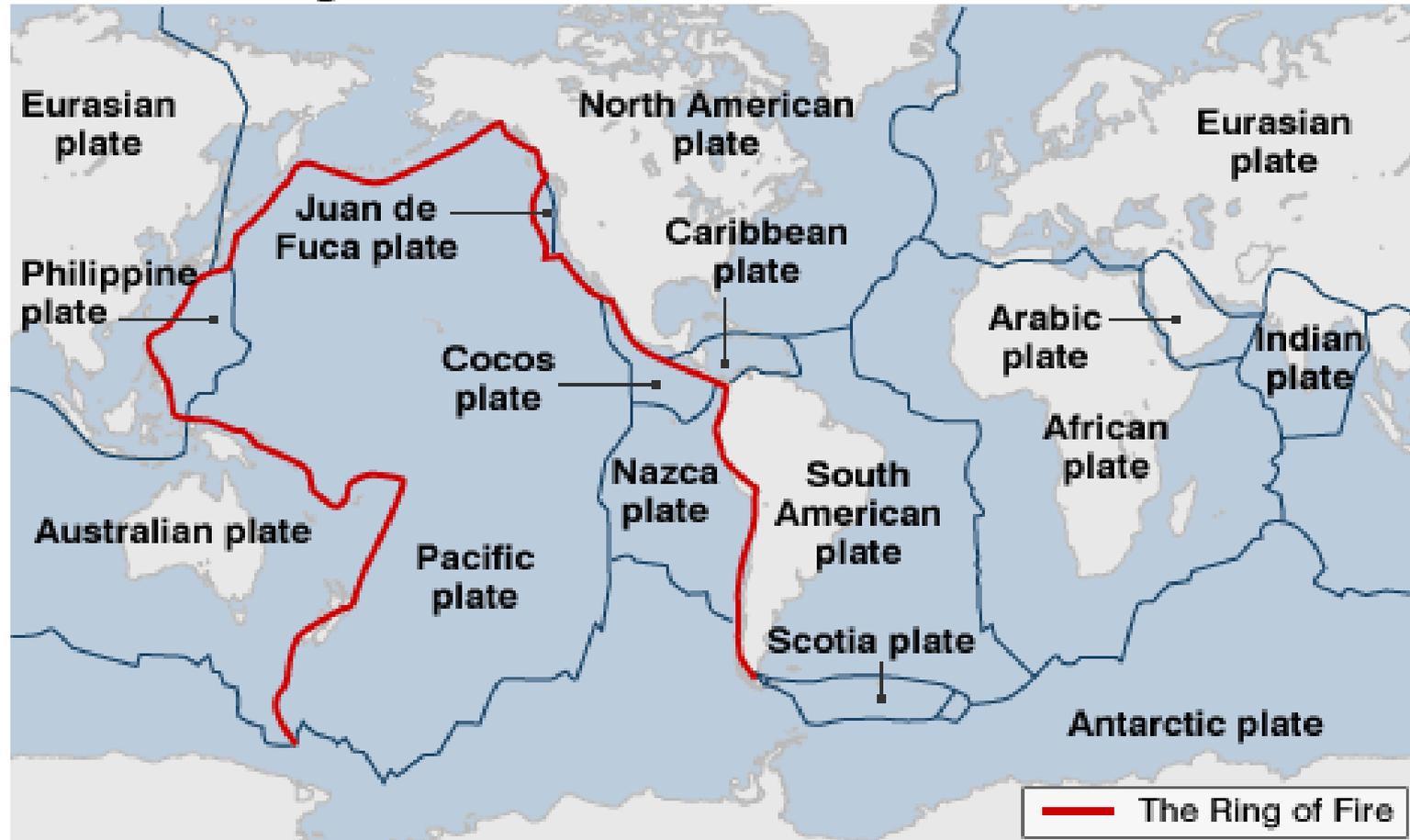
Pacific Ring Of Fire

- **Area on Earth where a large number of earthquakes and volcanic eruptions occur in the basin of the Pacific Ocean**
- **Activity here is a direct result of plate movements, specifically the collisions of lithosphere plates**
- **452 volcanoes**
- **90 % of the world's earthquakes occur here**

— Major trenches ■ Pacific Ring of Fire



The Pacific Ring of Fire







Great Rift Valley , Kenya



© Sebastian Wasek

Alfagja Rift - Iceland



Rio Grande
Rift,
New Mexico



© Alexander Mustard / Solent



Himalayas

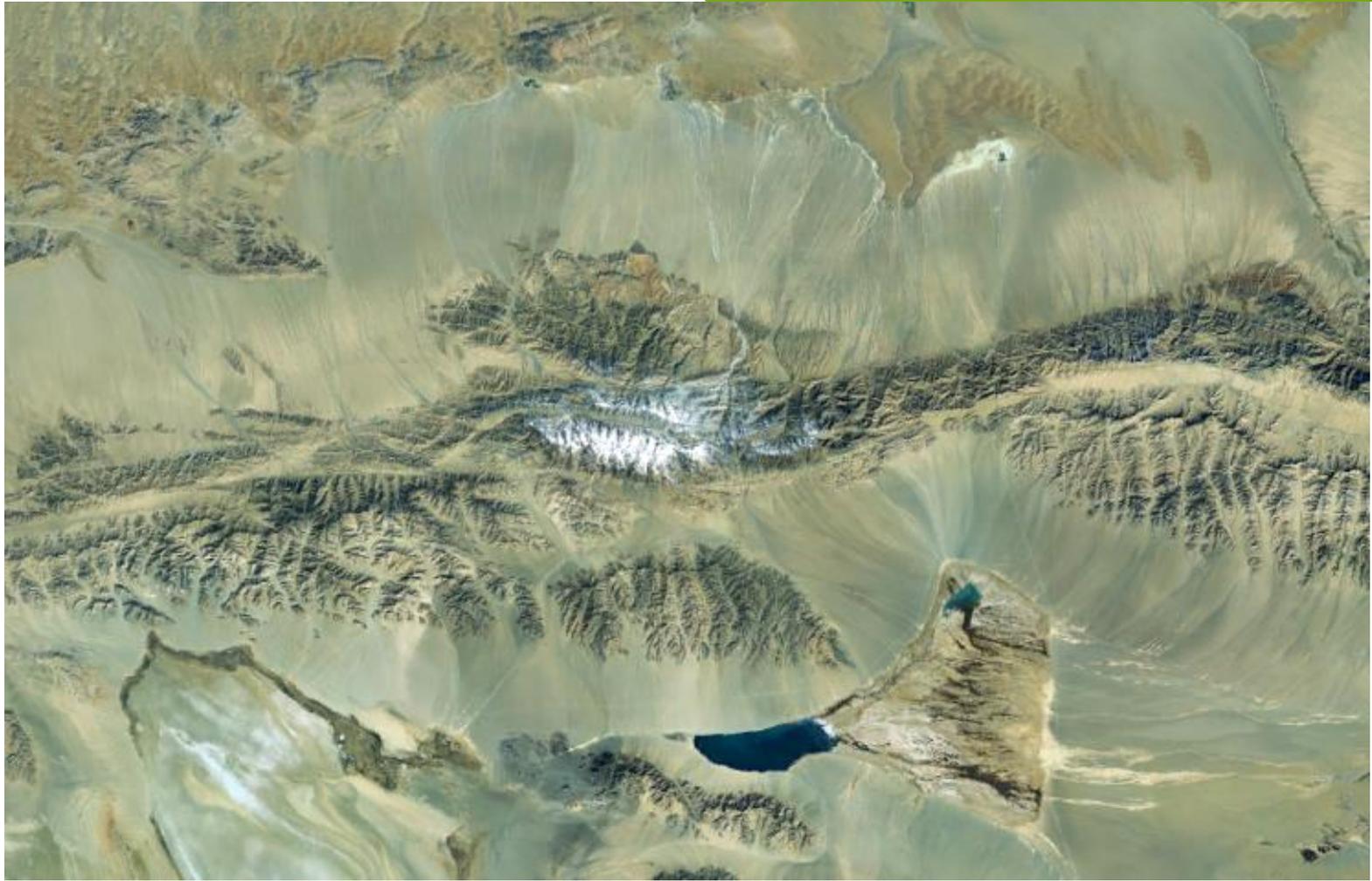




Alps



Alpine Fault – New Zealand



Atyn Tagh Fault